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**Binding means**

This invention relates to a means for binding wire around objects, for example bales of fiber material.

Pulp bales are bound around both individually and in the form of stacked units comprising a certain number of bales, usually six or eight bales. Such a unit load has a weight of between one and two tons. The strength of the wire binding tying together the unit load, therefore, is very important from a safety point of view, because several persons may stand near the load while it is being lifted by its wires. The equipment used for tying the knot in a bound wire loop and the knot itself, therefore, are subject of very comprehensive safety regulations and stringent safety controls.

The binding means comprises a unit for feeding the wire from a wire magazine through an openable wire guide bar around the object.

The feeding unit is used also for stretching the wire. The means comprises further a twining member, which includes a unit for locking the wire end, a unit for tying a wire knot, a cutting unit and a unit for projecting the knot.

The wire guide bar extends around the object to be bound and guides the wire at its feed. The wire is fed through the twining member around the object to be bound. When the free end of the wire arrives for the second time at the twining member, the wire is stopped and retained in the locking unit, whereafter the wire is stretched by reversing the feeding unit. The wire guide bar is thereby opened, and the wire is tightened around the object to be bound. The knot is tied, the wire is cut and projected out of the twining member.

In order to achieve an optimum binding and knot-tying result, the correct length of wire

must be fed. The wire normally is fed by means of a feeding wheel, which rotates through a predetermined number of revolutions and is driven, for example, by an electric servomotor. The feeding wheel is used also for stretching the wire.

In the wire magazine, on the path of the wire from the wire magazine to the feeding wheel, and in the wire guide bar, however, the wire can jam, whereby sliding can be caused between the feeding wheel and wire. Problems can also arise by variations in the wire quality, in its thickness and hardness, which result in sliding between the feeding wheel and wire.

The sliding creates problems during the feeding. The positions of the wire then cannot be determined, which may cause breakdowns. When then for avoiding sliding the contact pressure from the counter-pressure rolls is increased, there is risk of wire deformation whereby the feed of the wire through the different units in the binding means is made difficult.

The present invention offers a solution of the aforesaid problems, in that the measuring of the fed wire length takes place in a separate measuring means, which is not affected by sliding in the feeding wheel.

The characterizing features of the invention are apparent from the attached claims.

The invention is described in greater details in the following, with reference to the accompanying drawings illustrating an embodiment thereof.

Fig. 1 shows a binding machine.

Fig. 2 shows the measuring means.

The binding means is of the type shown and described in the patent SE 380 496 and in the patent application SE 9303380-1.

The binding means comprises a stand 1 on which the various units are arranged. A feeding unit 2 is provided to feed binding wire 3 in the form of steel wire from a wire magazine around an object 4 to be bound and thereafter to stretch the wire.

A measuring means 5 is provided for continuously measuring the fed wire length. The measuring is carried out without the measuring means 5 feeding the wire.

The measuring means 5 preferably comprises a runner 6, which abuts the wire 3, and a preferably compressed-air loaded dolly roll 15 to ensure that the wire 3 and runner 6 are in contact with each other.

The runner 6 has a contact surface 16, preferably with substantially straight profile. The measuring result is thereby less depending on the wire quality and varying contact pressure.

The runner 6 is coupled to a rotation meter 7, for example an inductive transmitter or a potentiometer, but preferably a pulse transmitter, which measures how much the runner 6 has rolled and, thereby, how much wire has passed the measuring means 5.

A wire guide bar 8 extends about the object to be bound 4. A twining member 9 comprises a guide bar for guiding the wire through the twining member, a unit for locking the wire end, a unit for tying a wire knot, a unit for cutting the wire, and a unit for projecting the completely tied knot.

The entire binding means preferably is movable so that it can be placed in a transport path for the objects to be bound and upon demand easily be exchanged.

The feeding unit 2 comprises guide wheels 10, about which the wire 3 runs, and a driven feeding wheel 11, to which counter-pressure rolls 12 abut. The feeding wheel 11 preferably is driven by an electric servomotor 13.

At the start of the binding machine the end of the wire 3 is positioned with the help of the values from the measuring means 5 to a pre-determined starting position for a binding sequence.

At the wire feed, the feeding unit 2 is driven by the electric servomotor 13, so that a pre-determined length of wire 3 is fed about the object to be bound 4, and the wire end arrives at the locking unit in the twining member 9. The fed wire length is measured by the measuring means 5. The wire end is retained in the twining member 9.

The wire stretching takes place thereafter by reversing the servomotor 13 of the feeding unit 2 until the wire has been stretched down onto the object to be bound 4, and the speed of the wire is zero. The wire movement is measured, for example, by a pulse transmitter in the servomotor 13, but preferably by the measuring means 5.

The wire guide bar 8 is openable and provided with grooves for the wire 3. During the wire feed, the bar 8 is held in closed position by piston/cylinder units 14, preferably pneumatic ones. At the wire stretching, the wire guide bar 8 is opened by the piston/cylinder units 14.

After the wire stretching, the units of the twining member 9 for twining, cutting and projecting the completed wire knot start to operate.

After the cutting, the wire is drawn back a predetermined length to the starting position for the next binding sequence by the feeding unit 2, which is controlled by values from the measuring means 5. The binding means is now ready for a new binding operation.

The invention, of course, is not restricted to the embodiments shown, but can be varied within the scope of the claims with reference to the descriptive part and drawing.